SYLLABUS

Course Title: Network Softwarization
Course Number: ECE-959
Course Credits:

Instructors: Michael Devetsikoitis / Fabrizio Granelli
E-mail: mdevets@unm.edu , fabrizio.granelli@unitn.it
Office Location: UNM Campus **Office Phone:** N/A
Office Hours: via Zoom, to be defined with students based on availability

Class Meeting Days: 2 days / week **Class Time:** 1,5 hours
Class Location / Room: Online **Term / Semester:** Spring

Course Description:
The course will provide a comprehensive overview of the individual building blocks (software defined networking; network function virtualization; information centric networks) enabling the concept of computing in future networks, starting from use cases and concepts over technological enablers (Mininet; Docker) and future innovations (machine learning; network coding; compressed sensing) to implementing all of them on personal computers.
Practical hands-on activities will be proposed, with realistic use cases to bridge theory and implementation by several examples, through the usage of a pre-built Virtual Machine (ComNetsEmu) that can be easily be extended for new experiments.

PART 1 INTRODUCTION: FUTURE COMMUNICATION NETWORKS AND SYSTEMS
- On the Need of Computing in Future Communication Networks
- Standardization Activities for Future Communication Networks
- Introduction to the hands-on environment:
    - Mininet: An Instant Virtual Network on Your Computer
    - Docker: Containerize Your Network Function
    - ComNetsEmu: A Lightweight Emulator
    - Useful networking tools

PART 2 KEY THEORETICAL CONCEPTS
- Network Slicing
- Mobile Edge Cloud
- Content Distribution

PART 3 ENABLING TECHNOLOGIES
- Software-Defined Networking (with hands-on lab on OpenFlow and different controllers)
- Network Function Virtualization (with hands-on lab on docker)

PART 4 DEPLOYING IN-NETWORK INNOVATIVE TECHNOLOGIES
- Deploying and migrating services (with simple hands-on examples)
- Machine Learning (with hands-on examples on routing, flow compression, congestion control, object detection)
- Network Coding (with hands-on on transport and storage applications)
- Compressed Sensing (with hands-on examples)

PART 5 ADDITIONAL LAB ACTIVITIES
- Connecting the testbed Virtual Machine to the Outer World
- Integrating Software Defined Radios

Course Goals:

- Students know basic principles and concepts in network virtualization and resource abstraction
- Students understand the major approaches to perform network slicing and network function virtualization
- Students gain practical know-how on implementing services in future networks

Student Learning Outcomes:

- Students can define the basic principles and concepts of network slicing and network function virtualization
- Students can implement and deploy slicing and virtualization in emulated and real scenarios
- Students can build testbeds and experiments on Software Defined Networking and Network Function Virtualization
- Students can design innovative solutions for next-generation networking

Textbooks/Supplies/Materials/Equipment/Technology or Technical Requirements:

- Course slides in pdf
- The course is based on a book co-edited by the instructor: F. Fitzek, F. Granelli, Patrick Seeling, "Computing in Communication Networks – From theory to practice," Elsevier (2020).
- A Virtual Machine will be provided to students in order to perform hands-on exercises and develop assignments and final term project
- Students are recommended to have a laptop or PC with a proper virtualization environment (VirtualBox is recommended) ready for the hands-on activities

Course Requirements:

There will be individual homework assignments, in-class quizzes and individual term projects. The term projects will use the network emulation software described in the course to develop network and services simulations to understand how to embed computing in modern communication networks.

Class Activity	**Percent Contribution**
Quizzes	20%
Homework Assignments	30%
Final Term Project	50%

Grading:

Final grades will be based on the sum of all possible course points as noted above.

Percentage of available points	**Grade**
90-100	A

80-89	B
70-79	C
60-69	D
<60	F

Course Schedule:
Wednesday and Friday, 9am Mountain Time (MT)

Accommodation Statement:
Accessibility Resources Center (Mesa Vista Hall 2021, 277-3506) provides academic support to students who have disabilities. If you think you need alternative accessible formats for undertaking and completing coursework, you should contact this service right away to assure your needs are met in a timely manner.

Title IX Statement:

Academic Integrity Statement:
Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course.
Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.